

What is claimed is:

1. A fluidic device comprising:  
at least one microchannel, and  
at least one capacitive micromachined ultrasonic transducer integrated into said  
5 microchannel.
2. A fluidic device as in claim 1 in which the microchannel has  
dimensions in the range 1  $\mu\text{m}$  to 500  $\mu\text{m}$  or more.
- 10 3. A fluidic device comprising:  
a base,  
at least one ultrasonic transducer integrated in said base, and  
a top having a microgroove sealed to said base with the microgroove over the  
ultrasonic transducer whereby to form a microchannel with an ultrasonic transducer in  
15 one wall of said channel.
4. A fluidic device as in claim 3 in which the microchannel has  
dimensions in the range of 1-500  $\mu\text{m}$ .
- 20 5. A fluidic device as in claim 3 or 4 in which the ultrasonic transducer is  
a capacitive micromachined ultrasonic transducer.
6. A fluidic device as in claim 4 including at least two spaced transducers  
and said top has its microgroove oriented over both of said transducers.
- 25 7. A fluidic device as in claim 4 in which the base is semiconductor  
material and the ultrasonic transducer is micromachined in said material.
8. A fluidic device as in claim 4 in which said microgroove includes a  
30 compliant membrane which is disposed opposite said ultrasonic transducer.
9. A fluidic device as in claim 4 including a processor for operating said  
ultrasonic transducer to emit pulses which echo off the opposite wall and process the

pulse and echo signals to provide a measure of the acoustic impedance of the fluid in said microchannel.

10. A fluidic device as in claim 6 including a process for operating said  
5 ultrasonic transducers to measure the time-of-flight of ultrasound in the direction and the opposite direction of fluid flow and provide a measure of fluid velocity.

11. A fluidic device as in claim 6 including a processor for driving said  
ultrasonic transducers to generate Stoneley waves for pumping fluid in said channels.  
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12. A fluidic device as in claim 8 in which a processor operates said  
transducer to generate ultrasonic pulses which are reflected by said membrane and  
processes the pulse and echo signal to measure the pressure of the fluid in said  
microchannel.  
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13. A fluidic device as in claim 12 including a plurality of ultrasonic  
transducers and membranes spaced along the channel to thereby measure the pressure  
drop along the channel.

14. A fluidic device as in claim 4 including a processor for operating said  
ultrasonic transducer to emit pulses and set ultrasonic resonance whereby to measure  
fluid properties or for counting particles in said fluid.  
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15. A fluidic device as in claim 4 in which the base is silicon or a dielectric  
25 material.

16. A fluidic device comprising:  
at least one microchannel having opposed walls,  
at least one capacitive micromachined ultrasonic transducer integrated into one  
30 wall, and  
a flexible membrane on the opposite wall opposite the ultrasonic transducer  
whereby ultrasonic waves from the ultrasonic transducer are reflected back to the  
transducer by the flexible membrane.

17. A flexible device as in claim 9 including a processor configured to process signals to and from said ultrasonic transducer and providing an output indicative of pressure.

5 18. A fluidic device comprising:  
a silicon base,  
one or more capacitive micromachined ultrasonic transducers integrated into said base, and  
a top having a microgroove sealed to said base with the microgroove over said  
10 capacitive micromachined ultrasonic transducers.

19. A fluidic device as in claim 18 including at least two capacitive micromachined transducers spaced along said channel.

15 20. A fluidic device as in claim 19 including a processor for operating said transducers in a pulse echo mode.

21. A fluidic device as in claim 19 including a processor for operating said transducers to receive ultrasonic pulses from one another.

20 22. A fluidic device as in claim 18 in which said microgroove includes a compliant membrane opposite said ultrasonic transducer.

25 23. A fluidic device as in claim 18 in which the micromachined ultrasonic transducer is operated to mix fluids in the channel.

24. A fluidic device as in claim 18 in which the ultrasonic transducer is operated to pump fluids in said channel.

30 25. A fluidic device as in claim 18 in which said ultrasonic transducer is operated to measure fluid characteristics.

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